



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/790,403	03/01/2004	M. Selim Unlu	BU-021AX	1449
207 7590 10/29/2007 WEINGARTEN, SCHURGIN, GAGNEBIN & LEOVICI LLP TEN POST OFFICE SQUARE BOSTON, MA 02109			EXAMINER WILCZEWSKI, MARY A	
			ART UNIT 2822	PAPER NUMBER
			MAIL DATE 10/29/2007	DELIVERY MODE PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

## Office Action Summary

Application No.

10/790,403

Applicant(s)

UNLU ET AL.

Examiner

M. Wilczewski

Art Unit

2822

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 15 August 2007 and 04 October 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-31 is/are pending in the application.
- 4a) Of the above claim(s) 1-12 and 27-31 is/are withdrawn from consideration.
- 5) ☒ Claim(s) 13-23 is/are allowed.
- 6) ☒ Claim(s) 24-26 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 15 June 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)                       | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | Paper No(s)/Mail Date. _____                                      |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>02 April 2007</u> .   | 6) <input type="checkbox"/> Other: _____                          |

## **DETAILED ACTION**

### ***Continued Examination under 37 CFR 1.114***

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on August 15, 2007, has been entered.

In light of the amendments made to claim 24, the rejection of claims 24-26 under 35 U.S.C. 112, second paragraph, and the objection to claim 26 under 37 CFR 1.75(c) have been withdrawn.

Claims 1-31 are pending in this application. Claims 1-12 and 27-31 have been withdrawn from consideration. Claims 13-23 are allowed. Claims 24-26 are herein rejected.

### ***Drawings***

One sheet of replacement drawings was received on June 15, 2006. These drawings are acceptable.

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 24-26 are again rejected under 35 U.S.C. 103(a) as being unpatentable over Abe et al., Patent Application Publication 2001/0032977, of record, in view of Yamazaki et al., US Patent 6,335,231, both of record.

Abe et al. disclose a method of fabricating a buried reflective layer in silicon by a method as shown in Figure 9 which comprises: providing a first silicon substrate having a silicon dioxide (A) layer on a surface thereof, providing a second silicon substrate 16, implanting hydrogen into the first silicon substrate to a predetermined depth (20) forming a boundary between the hydrogen-implanted silicon and the unimplanted silicon on either side thereof (paragraph [0059]), bonding the two substrates at room temperature (paragraph [0059]) and annealing the wafers at a temperature of 800-1100°C (paragraph [0050] and [0063]) to promote cleaving or fracturing (splitting, destacking) of the hydrogen implanted regions 20 and to strengthen the bond (paragraphs [0051] and [0063]), separating the silicon at the hydrogen boundary thereby exposing a separated surface and then repeating the above-identified steps, i.e., providing another silicon wafer having a silicon dioxide layer thereon, implanting hydrogen into that wafer, bonding that wafer to the exposed silicon surface and

separating to expose a separated surface (paragraph [0051], [0060], and [0064]). Abe et al. lack anticipation only of performing an heating step to a cleaving temperature, as recited in lines 10-16 of claim 24.

Yamazaki discloses a method of fabricating an highly reliable SOI substrate which comprises providing a first silicon wafer 101 having a layer of silicon dioxide 102 on a surface thereof (Fig. 1A), providing a second silicon wafer 104 (Fig. 1C), implanting hydrogen to a predetermined depth 103 in silicon wafer 101 thereby forming a boundary between hydrogen implanted silicon and unimplanted silicon on either side thereof, bonding the two silicon wafers together by heating to promote cleaving or fracturing of regions containing hydrogen from regions not containing hydrogen (Figs. 1C and 1D) by first heating at 400 to 600 °C to cause cleaving followed by a second heating step at 1050 to 1150 °C to strengthen the bond (col. 6, lines 16-32), separating the silicon at the hydrogen boundary thereby exposing a separated surface (Figs. 1D and 1E).

Yamazaki teaches a wafer bonding process that is very similar to that of Abe et al. Yamazaki clearly teaches to bond the wafers and to perform a first heat treatment at a cleaving temperature in order to promote cleaving of the regions containing hydrogen from those regions not containing hydrogen and to perform a second heat treatment at a bond strengthening temperature to strengthen the bond between the two wafers. Yamazaki clearly teaches that this two-step heat treatment yields a stabilized bonding interface, which is very strong (see col. 6, lines 33-37, of Yamazaki). Therefore, it would have been obvious to one skilled in the art that the two-step heat treatment of

Yamazaki could be substituted for the single annealing step of Abe et al. thereby yielding a very strong, stabilized bonding interface.

Yamazaki also teaches to form a silicon epitaxial layer on the silicon fractured at the boundary, see Figures 3A-3F and column 6, lines 64-67. It is well known in the art that forming a device in an epitaxial layer enables the doping concentration of the device to be accurately controlled and enables the growth of a high quality layer that is both oxygen and carbon free. Therefore, it would have been obvious to one skilled in the art to form an epitaxial layer in the known method of Abe et al. so that the optical function device of Abe et al. could be formed in the epitaxial layer, since the epitaxial layer would be of a higher quality than the substrate for forming the device.

### ***Response to Arguments***

Applicant's arguments filed August 15, 2007, have been fully considered but they are not persuasive. Applicant has argued that Yamazaki does not teach a buried layer **comprising alternating silicon and silicon dioxide layers which form the distributed Bragg reflector (DBR)**. First, although claim 24 recites that alternating layers of silicon and silicon dioxide are provided (lines 28-30 of claim 24), the claim does not recite that a distributed Bragg reflector is formed. Therefore, Applicant's arguments are not commensurate in scope with claim 24, as it is presently written.

Second, Yamazaki has only been relied upon as a teaching to heat the bonded silicon bodies to strengthen the bond, i.e., promote bonding, and cleaving or fracturing. Yamazaki et al. further teach that the heating is done in two steps, the first heating step

to a cleaving temperature (column 6, lines 16-23, and figure 1D) and the second heating step to a bond strengthening temperature (column 6, lines 24-36, and figure 1E).

Therefore, Yamazaki need not teach or suggest that the disclosed method can be used to form alternating silicon and silicon dioxide layers, since this feature of the claimed invention is clearly taught by the primary reference (Abe et al.). It has been well established that to be useful in an obviousness combination, a secondary reference should be used for what it teaches and need not be bodily substituted into the primary reference structure. In re Richman 165 USPQ 509, 514 (CCPA 1970). Therefore, Yamazaki et al. need not teach a structure comprising alternating layers of silicon and silicon dioxide to be properly combined in an obviousness rejection with Abe et al.

### ***Allowable Subject Matter***

Claims 13-23 are allowable over the prior art of record.

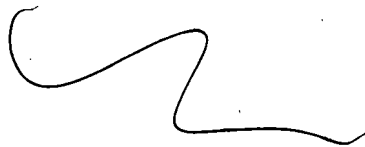
### ***Conclusion***

This application contains claims 1-12 and 27-31 drawn to an invention non-elected with traverse in the Response filed December 5, 2005. Although Applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, a complete reply to this rejection should include cancellation of these non-elected claims or other appropriate action (37 CFR 1.144).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to M. Wilczewski whose telephone number is (571) 272-1849. The examiner can normally be reached on Monday-Thursday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Zandra Smith can be reached on 571-272-2429. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



M. Wilczewski  
Primary Examiner  
Tech Center 2800